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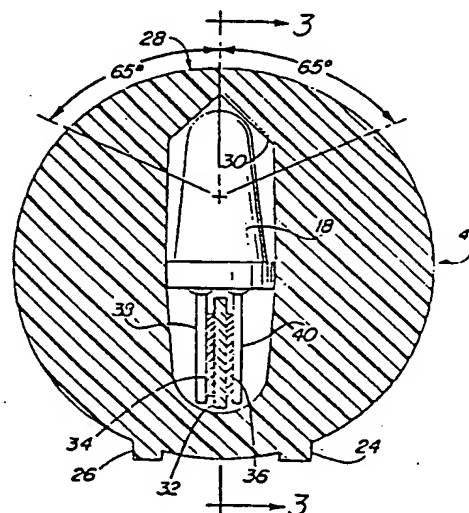
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(54) A flexible elongated lighting system.

(57) A lightweight emergency lighting system capable of arrangement into various subjective configurations is provided. A housing member (4) supports a plurality of individual lighting elements (18) mounted on a common semi-rigid bus bar (32). The upper configuration of the housing member is capable of a directional transmission of light towards a predetermined field angle, while the lower configuration is adaptable for mounting the lighting elements. The upper housing member can have an interior surface of a prismatic configuration (30) to provide a refraction and reflection of light in combination with the exterior surface. The lighting elements (18), such as L.E.D.'s, can be excited through a pulsing circuit to maximize the light output while conserving power from an auxiliary battery source.

FIG. 2



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8 A FLEXIBLE ELONGATED LIGHTING SYSTEM
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10 BACKGROUND OF THE INVENTION

11 1. Field of the Invention

12 The present invention is directed to a light-
13 weight flexible elongated lighting system, and more
14 particularly to a lighting system which is adapted for
15 activation in emergency situations to provide occupants
16 with an egress from a structure, such as an aircraft.

17 2. Description of the Prior Art

18 Numerous examples of elongated lighting
19 systems for indicating paths of egress and also for
20 providing residential and occupational illumination have
21 existed in the prior art.

22 Additionally, emergency lighting systems that
23 can be autonomously activated, apart from a principal
24 source of conventional power, are frequently utilized
25 and sometimes even required by building codes and other
26 regulations. In the military, emergency lighting
27 systems have been proposed, such as disclosed in U.S.
28 Patent No. 4,365,232, to mark exits or escape hatches,
29 e.g. on aircraft. A particular problem has occurred
30 with helicopters, especially on flights over water,
31 wherein due to their high center of gravity, the
32 helicopter body will invert after a crash. Upon the
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1 inversion of the helicopter and in view of the
2 consequential confusion produced on its occupants, it
3 becomes extremely difficult to leave a sinking
4 helicopter due to darkness or low visibility in water
5 and the inverted state of the craft. If the occupants
6 do not evacuate immediately from the helicopter,
7 drowning will result. Other examples of emergency
8 lighting systems in the environment of military aircraft
9 are disclosed in U.S. Patents No. 3,411,131, and U.S.
10 Patent No. 3,428,941.

11 The prior art has also suggested flexible
12 elongated strip light systems, for example, in U.S.
13 Patent No. 4,376,966, U.S. Patent No. 4,271,458, and
14 U.S. Patent No. 4,107,767. The Litelab Corporation of
15 New York, New York, provides a low voltage tube light
16 under the trademark "Xanadu". Various configurations of
17 tube lights are offered from either a shatterproof rigid
18 polycarbonate or a cylindrical flexible polyvinyl-
19 chloride material

20 There is a present need in the prior art to
21 provide a flexible elongated lighting system capable of
22 an efficient and optimum use of the light generated, and
23 more particularly to provide an automatic emergency
24 egress lighting system which can accomodate a diversity
25 of sizes and shapes of points of egress, such as the
26 escape doors and hatches on military helicopters.

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28 SUMMARY OF THE INVENTION

29 The present invention relates to an elongated
30 lighting system which can be used as a lightweight
31 emergency lighting system on aircraft, such as
32 helicopters, to identify an exit. This lighting system
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1 comprises an elongated flexible waterproof housing
2 member that is capable of a directional transmission of
3 light towards an optimum predetermined field angle. The
4 housing member is transparent and can be bent to define
5 a subjective outline of an exit. A plurality of
6 individual lighting elements are electrically mounted in
7 parallel in the housing member and are spaced along a
8 substantial portion of its length. The housing member
9 is preferably provided with a variable thickness upper
10 portion to optimize both refraction and reflection of
11 the generated light and with a lower portion to
12 facilitate the mounting and positioning of the lighting
13 elements along the length of the housing member and also
14 to a support structure. The lighting elements, in a
15 preferred embodiment, can comprise light emitting diodes
16 which can be driven by pulsed excitation of an
17 appropriate width and peak to provide an optimum level
18 of light without risking damage to the L.E.D.'s while
19 conserving an auxiliary power source. While the
20 lighting system can be energized from conventional
21 sources of power, it is contemplated that an autonomous
22 battery system will be provided to be activated in the
23 case of an emergency. Activation can occur through a
24 manual switch, an automatic disruption of the
25 conventional power source, or upon a sensing of an
26 emergency situation, such as the presence of water.

27 The preferred embodiment disclosed herein
28 utilizes an extruded lightweight flexible transparent
29 plastic resin for the housing member which is extruded
30 to provide interior and exterior surfaces for reflection
31 and refraction of the generated light to maximize the
32 illumination perceivable by the occupants in emergency
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1 situations. Such emergency situations can constitute an
2 environment under water or in the presence of smoke and
3 fire.

4 The features of the present invention which
5 are believed to be novel are set forth with
6 particularity in the appended claims. The present
7 invention, both as to its organization and manner of
8 operation, together with further objects and advantages
9 thereof, may best be understood by reference to the
10 following description, taken in conjunction with the
11 accompanying drawings.

12 BRIEF DESCRIPTION OF THE DRAWING

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14 FIG. 1 is an illustrative perspective view of
15 an emergency lighting system mounted about an egress
16 point of an aircraft;

17 FIG. 2 is a side cross sectional view of the
18 light housing member and light emitting diodes
19 transverse to the longitudinal axis;

20 FIG. 3 is a side cross sectional view taken
21 along line 3 - 3 of FIG. 2;

22 FIG. 4 is a cross sectional view of a second
23 embodiment of the light housing of the present
24 invention;

25 FIG. 5 is a cross sectional view of a third
26 embodiment of the light housing of the present
27 invention,

28 FIG. 6 is a cross sectional view of a fourth
29 embodiment of the light housing of the present
30 invention;

31 FIG. 7 is a cross sectional view of a fifth
32 embodiment of the light housing of the present
33 invention;

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1 FIG. 8 is a schematic illustration of an
2 electric circuit of the present invention; and

3 FIG. 9 is a schematic illustration of the
4 pulsing circuitry of the present invention.

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6 DESCRIPTION OF THE PREFERRED EMBODIMENTS

7 The following description is provided to
8 enable any person skilled in the optical and electrical
9 field to make and use the invention and sets forth the
10 best modes contemplated by the inventor of carrying out
11 his invention. Various modifications, however, will
12 remain readily apparent to those skilled in these arts,
13 since the generic principles of the present invention
14 have been defined herein specifically to provide a
15 relatively economical and easily manufactured elongated
16 lighting system particularly adapted for use as an
17 emergency egress lighting system.

18 Referring to FIG. 1, the interior of a
19 vehicle, e.g., a helicopter is partially shown, and more
20 particularly an egress or escape door is illustrated.
21 Mounted about the upper sides and top of the door is the
22 emergency lighting system 2 of the present invention in
23 an inverted U configuration to provide distinct
24 orientation to an observer. The lighting system 2
25 includes an elongated flexible waterproof housing member
26 4 which is sealed at one end by a cap 6 and both sealed
27 and electrically connected to a control unit 8 at the
28 other end. The housing member 4 can be appropriately
29 mounted to the walls of the helicopter by a plurality of
30 mounting clips 10.

31 The cap 10 can include an interconnection
32 adapter which has been welded to the housing member 4
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1 and which in turn is closed by a plug assembly, usually
2 incorporating a retainer for anchoring the contact strip
3 of the lighting elements to be described subsequently.
4 Specifically, the end cap, although not shown in detail,
5 provides a waterproof connection and an anchor point
6 (not shown) for mounting the contact strip of lighting
7 elements to be described subsequently. Specifically,
8 the cap 6, although not shown in detail, provides a
9 waterproof closure and anchor point for the contact
10 strip.

11 The control unit 8 serves the function of
12 providing a waterproof housing for a plurality of
13 batteries, such as rechargeable nickel-cadmium
14 batteries, and also for mounting a printed circuit board
15 (not shown) which interconnects with a conventional
16 source of power from the vehicle via power conduit line
17 12. A manual test switch 14 can be subjectively
18 positioned on the control unit 8 to determine the
19 operability of the emergency lighting system 2.

20 While not shown in FIG. 1, a disable switch 16
21 can be mounted within the interior of the control unit 8
22 for deactivating the emergency lighting system 2, for
23 example, if the escape door is blocked. As with the end
24 cap 6, the connections to control unit 8 by the housing
25 member 4 and the power line 12 are made with waterproof
26 seals.

27 Referring to FIG. 2, a cross sectional view
28 taken transverse to the longitudinal axis of the housing
29 member 4, is provided. The housing member 4 can be
30 formed from an extruded polyvinyl material, such as
31 TYGON, a plastic material known in the prior art and
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1 sold by Norton Products Co. The specific configuration
2 of the housing member is designed to provide an optimum
3 utilization of the generated light from a plurality of
4 lighting elements 18 which are spaced along the length
5 of the housing member 4. In the preferred embodiment,
6 the lighting elements 18 can be light emitting diodes
7 (L.E.D.) which are capable of instantaneous activation
8 in an emergency condition. The configuration of the
9 housing member 4 is also acceptable for an operative
10 working with other forms of illumination, such as
11 incandescent lights, but the description hereinafter
12 will be directed to the utilization of light emitting
13 diodes.

14 The bottom portion of the light housing member
15 4 is provided with spacing flanges 24 and 26 for
16 interfacing with the mounting brackets 10. The flanges
17 also insure an optical alignment of the upper housing
18 portion of the housing member 4 relative to the mounting
19 surface.. As described earlier, the mounting brackets
20 10 are utilized for the appropriate securement of the
21 lighting housing member 4 to the vehicle structure.
22 Appropriate metal brackets or plastic tie strips could
23 be utilized to provide either a permanent or removeable
24 mounting to the support structure, such as the bulkhead
25 of the helicopter.

26 The housing member 4 can also provide a dual
27 function in its interface with the lighting elements 18.
28 The prime function is its ability to distribute the
29 light from the lighting element 18 in an optimally
30 efficient manner. In this regard, the structure dis-
31 closed in FIGS. 2 and 3 and also FIGS. 5 through 7
32 define various configurations for the distribution of
33 light. Preferably the light will be distributed over a
34 field angle of at least ± 65 degrees about the normal
35 to the axis of the light element 18, as viewed in

not true as cavity extends along
entire length of housing

1 FIG. 2. The design intent is to utilize all the light X
2 available, so that an auxiliary power source can be
3 optimized in the terms of weight. Thus, to achieve the
4 advantages of the present invention, it is important for
5 the upper portion of the housing member 4 to have a
6 configuration which directs the light from the lighting
7 elements 18 in a predetermined field angle that will
8 insure viewing without wasting any of the power and
9 light which is generated.

10 The cross sectional view of FIG. 2 taken
11 transverse to the longitudinal axis of the housing
12 member 4 and the cross sectional view of FIG. 3 taken
13 along the longitudinal axis of the housing member 4
14 discloses a spherical outer surface 28 and two internal
15 planar surface 30, effectively producing double prisms
16 within the housing wall. The prismatic internal surface
17 30 comprises two planar facets forming side corner edges
18 and a central apex point that extend the entire length
19 of the housing member 4. Preferably, this housing
20 configuration and the other embodiments will provide a
21 viewing angle of at least 130 degrees or greater to the
22 occupants. Thus, a person adjacent to a wall of the
23 structure and at a distance from the egress opening will
24 still be able to perceive the emergency light under
25 adverse conditions. As can be appreciated, the
26 particular light distribution will be a function of the
27 light emitting characteristics of the lighting element
28 18 and the reflective and refractive characteristics of
29 the internal and external surfaces. Modifications in
30 the light housing envelope to enhance these
31 characteristics for a specific lighting element is
32 possible.
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1 The lower portion of the housing member 4
2 serves a secondary function of providing a frictional
3 mounting for the lighting elements 18. The lighting
4 elements 18 are spaced along the length of the housing
5 member 4, e.g., approximately twelve or more L.E.D.'s
6 can be mounted per foot of housing member 4. The number
7 of L.E.D.'s, along with the manner of energizing them,
8 to be described subsequently, will affect the level of
9 illumination. Each of the L.E.D. elements 18 will be
10 connected in parallel to the power source, e.g., a
11 battery pack contained in the control unit 8. The
12 configuration of the lower housing portion of the
13 housing member 4 is designed to accomodate a double bus
14 mounting of a flexible plastic insulating strip 32 which
15 supports on either side, a flat copper conducting ribbon
16 34 and 36 bonded to the insulating strip 32. The
17 respective terminal pins 38 and 40 of the L.E.D. will
18 straddle the bus strip and will be lap soldered to the
19 conductive ribbons 34 and 36, respectively.

20 This particular arrangement is designed for
21 optimum flexibility along the plane of bending during
22 installation. The plastic strip 32 is relatively rigid
23 along a plane parallel to the light element axis and
24 will cooperate in maintaining the L.E.D. configuration
25 in a correct orientation in the light housing member 4.
26 The L.E.D.'s can be of an appropriate color, such as
27 green, that can be subjectively determined for the
28 particular emergency situation and environment that the
29 present invention will address. The L.E.D's offer a
30 higher efficiency in the conversion of input power,
31 e.g., green light relative to an incandescent light
32 source with a filter. It was found that L.E.D.'s are
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1 unique in that a relatively narrow spectral band of
2 green light is emitted with a peak wavelength in the
3 green region having a bandwidth of about twenty to
4 thirty-five nanometers. The advantage of green light is
5 that it has a minimal attenuation when traversing
6 through water. The contemplated L.E.D.'s have an
7 operating voltage of two volts with a peak emission
8 wavelength of 565 nanometers and a spectral bandwidth of
9 approximately thirty-five nanometers. The full emission
10 cone angle is approximately 10 degrees, and the
11 particular design of the upper lighting housing member 4
12 is suggested for optimizing the disbursement of this
13 light over the predetermined field angle that is
14 desired.

15 The respective embodiments for the light
16 housing member 4 suggested in FIGS. 4 through 7 also
17 disclose a flat external surface which could have a
18 rough configuration for disbursement or scattering of
19 the egressing light. In FIGS. 4 and 5, a curvilinear
20 configuration is provided for the interior of the
21 housing member 4 with an exterior spherical surface. In
22 FIG. 6, a flat external surface is provided in
23 conjunction with an internal hemispherical surface. In
24 FIG. 7, a flat exterior surface is provided with an
25 internal surface that includes a pair of corner edges
26 extending along the axial length of the housing member
27 4. The corner edges are also a characteristic of the
28 embodiment disclosed in FIGS. 2 and 3. FIG. 7 discloses
29 a cross sectional square configuration for its interior
30 surface in combination with a flat exterior surface.
31 Each of the housing members 4 have a tubular or
32 substantially tubular configuration, depending upon
33 whether a flat exterior surface is provided. In the
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Loc. 4
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1 preferred embodiment the interior configuration of the
2 housing member 4 provides for a frictional holding of
3 the lighting elements 18 in an operative position.
4 However, an advantage of the semi-rigid plastic support
5 strip 32 permits the advantages of the present invention
6 to be utilized without resorting to a frictional holding
7 of the lighting elements 18.

8 The choice of L.E.D.'s as the preferred
9 lighting elements provides a limitation in the intensity
10 of light emitted. However, a particular advantage is
11 achieved by resorting to a pulsing power source in that
12 an optimization of the intensity of light from the
13 L.E.D.'s can be achieved, and the utilization of the
14 average power from a battery supply can be extended.

15 The human eye, from the standpoint of temporal
16 response and sensitivity characteristics, can perceive,
17 particularly in a dark environment, a pulsed excitation
18 as, in fact, a steady light source. Furthermore, by
19 selecting an appropriate pulsing cycle, it is possible
20 that the source can be more visually noticeable and
21 discriminated through any highly scattering medium, such
22 as fog, smoke, turbid water, etc. than a light source
23 that is constantly on and is subject to a persisting
24 scattering of light. By pulsing the L.E.D.'s, the
25 intensity of the emitted light can be increased by the
26 use of a higher current level per pulse.

27 Referring to FIG. 8, an electronic circuit is
28 disclosed which is provided on the printed circuit board
29 mounted in the control unit 8. The electronic circuit
30 is designed to activate the emergency lighting system 2
31 of the present invention under certain conditions and,
32 with reference to FIG. 9, in the preferred embodiment, a
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1 pulsing circuit will be provided for activating the
2 L.E.D. elements 18. As can be readily appreciated,
3 variations of these circuits are possible to achieve the
4 same purpose of the present invention.

5 Basically, the circuit comprises a control
6 switch function that can include a pilot arming switch
7 42 and, optionally, a trigger control switch 44, such as
8 a water activated switch of the type disclosed in U.S.
9 Patent No. 3,994,049 and U.S. Patent No. 4,012,671 which
10 are incorporated herein by reference. The arming switch
11 circuit consists of a transistor and associated biasing
12 components.

13 A power latch circuit consists of a silicon
14 rectifier 46 and its biasing components which are
15 normally opened by the activation of a control relay 48
16 that is powered by a conventional power source, such as
17 an inboard electrical generator, e.g., a 28 volt D.C.
18 source in a helicopter. As long as this 28 volt source
19 is present, the control relay 48 will maintain the
20 L.E.D.'s in an off condition. Also connected to the
21 principal power source is a trickle charging circuit 50
22 to insure that the nickel-cadmium batteries 58 are
23 maintained in a charged state.

24 In a power off condition, the arming switch 42
25 is usually open. When the aircraft is under power, a 28
26 volt direct current control signal maintains the control
27 relay 48 in an open position. The pilot then can arm
28 the emergency lights 18 by closing switch 42. Closing
29 switch 42 provides a current path through resistor R4 to
30 supply base current to the transistor 52. Transistor
31 52 is then turned on, and a trigger current is supplied
32 through resistor R4 to the gate of the silicon recti-
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1 fier 46. The SCR 46 appears as a closed switch but the
2 light elements 18 will not come on because of the open
3 circuit caused by the activated control relay 48 which
4 opens the normally closed contacts 54. Switch 16 which
5 is mounted within the control unit 8 is capable of
6 de-activating the entire emergency lighting system 2, in
7 case the exit or egress point is inoperative or blocked.
8 A current limiting resistor 15 is connected between
9 switch 16 and the lighting elements 18. Switch 14 is
10 mounted with a waterproof seal in the control unit 8 and
11 can be manually activated to bypass the open contacts 54
12 for testing the operativeness of the actual lighting
13 elements 18. The trickle charging circuit 50 is
14 continually activated to insure that the batteries 58
15 are constantly kept in a charged state for use in an
16 emergency situation.

17 As can be appreciated, a large number of
18 lighting elements 18 can be mounted in parallel
19 depending on the illumination required, although only
20 a few are disclosed in the circuit of FIG. 8.

21 In an emergency and upon removal of the 28
22 volt line current which is carried to the control unit 8
23 by the power line 12, the control relay 48 will be de-
24 activated, and the contacts will be closed, allowing the
25 lighting elements 18 to be activated. In the preferred
26 embodiment, a pulsing circuit, FIG. 9, is interposed
27 between terminal 56 and ground and is mounted on the
28 same printed circuit board as the primary control
29 circuit for the light elements 18. This pulsing circuit
30 causes the current flow to periodically alternate
31 between a high and a low value.
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1 This pulse excitation of the lighting elements
2 18, particularly when the lighting elements 18 are
3 L.E.D.'s, provides two distinct advantages in the
4 present invention. First, a maximum generation of light
5 is capable from the L.E.D.'s, and, e.g., by selecting
6 green L.E.D.'s, a maximum utilization of the efficiency
7 is achieved in adverse or hostile conditions. Secondly,
8 the pulsing of the L.E.D.'s specifically conserves the
9 auxiliary and autonomous power supply available through
10 the batteries 58 and thereby extends the active life of
11 the emergency lighting system 2. As can be readily
12 expected, it is highly desirable for the system to
13 operate with a high degree of reliability for at least a
14 sufficient amount of time to permit the occupants to
15 leave the structure.

16 The pulsing circuit is based upon a
17 commercially available programmable timing circuit 60
18 such as a circuit manufactured by Signetics Inc. under
19 the designation NE555. Circuit 60 is connected in the
20 astable or oscillating configuration. Pins 8 and 4 are
21 connected directly to terminal 56. A resistor 62 is
22 connected between pin 7 and terminal 56 with a second
23 resistor being connectd between pins 7 and pins 2 and 6.
24 A capacitor 66 is also provided which is connected
25 between pins 2 and 6 and ground. Pin 1 is connected
26 directly to ground and pin 5 is connected to ground
27 through a capacitor 68. Output pin 3 is connected to
28 the base of a NPN transistor 70 by way of a resistor 72.
29 The emitter of transistor 70 is connected directly to
30 ground with the collector being connected to terminal 56
31 through a resistor 74. Finally, a resistor 76 is
32 connected between terminal 56 and ground.

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1 The output of circuit 60 at pin 3 alternates
2 between a relatively low and high voltage. The ratio of
3 the high voltage period to the low voltage period (duty
4 cycle) and the repetition rate frequency of the circuit
5 60 output may be selected by varying the values of
6 resistors 62 and 64 and capacitors 66 and 68. When the
7 output on terminal 3 is low, transistor 70 is off.
8 Accordingly, the effective impedance between terminal 56
9 and ground is the value of resistor 76 which is low in
10 comparison to the value of resistor 62. When the output
11 on terminal 3 is high, transistor 70 is turned on,
12 thereby effectively placing resistor 74 in parallel with
13 resistor 76. Resistor 74 is typically somewhat lower in
14 value than resistor 76. Accordingly, the effective
15 impedance between terminal 56 and ground is
16 substantially reduced when transistor 70 is on.

17 The magnitude of the alternating high and low
18 current flow through light elements 18 can be adjusted
19 by varying the values of resistors 74 and 76. Resistor
20 76 can be a relatively high value so that the light
21 elements are effectively turned off when transistor 70
22 is off, so long as the minimum SCR 46 holding current is
23 maintained. Alternatively, resistor 76 can have a
24 somewhat lower value so that the intensity of
25 illumination of lighting elements 18 will modulate
26 between a low and high value. A repetition rate
27 approximately on the order of 125 cycles per second with
28 a 25 percent high/low duty cycle has been found suitable
29 for this application. Other frequencies and duty cycles
30 can be achieved by varying the values of the appropriate
31 components of the pulsing circuit, as previously noted.

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1 In summation, the present invention provides a
2 lightweight flexible light source that can be activated
3 in an emergency situation. As can be readily
4 appreciated, it is possible to deviate from the above
5 embodiments of the present invention and, as will be
6 readily understood by those skilled in the art, the
7 invention is capable of many modifications and
8 improvements within the scope and spirit thereof.
9 Accordingly, it will be understood that the invention is
10 not to be limited by the specific embodiments but only
11 by the scope and spirit of the appended claims.
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WHAT IS CLAIMED IS:

1. A lighting system capable of arrangement into various subjective configurations, comprising:

5 a flexible housing member of an elongated configuration capable of transmitting light transverse to its length;

10 a plurality of individual lighting elements having an upper light emitting surface and a lower base portion positioned within the housing member and respectively spaced from each other along its length, one portion of the interior surface of the housing member is configured to receive the base portion of the lighting elements while an opposite portion has a prismatic configuration complementarily to the light emission characteristics of the lighting elements or directing any light emitted towards
20 predetermined directions, and

25 means for electrically inter-connecting the lighting elements whereby connection to a source of electrical power can illuminate the lighting elements to transmit light throughout the housing member.

2. The invention of claim 1 wherein the interior shape of the housing member is formed of planar facets and the lighting elements are light emitting diodes of a predetermined wavelength band.

3. The invention of claim 1 wherein the planar facets reflect and refract the incident light.

4. The invention of claim 1 wherein the housing member is formed of an extended plastic resin material of an approximately tubular shape.

5. The invention of claim 1 further including means for automatically activating the lighting system upon contact with water.

6. The invention of claim 1 wherein the means for electrically interconnecting the lighting elements includes an insulating bus strip laterally flexible and longitudinally relative stiff, the insulating bus strip supporting electrical contacts common to each lighting element.

7. The invention of claim 1 wherein the housing member includes a flat exterior surface and a non-planar interior surface for directing light.

8. The invention of claim 1 wherein the housing member has an interior surface that includes a pair of corner edges extending along the axial length of the housing member.

9. The invention of claim 1 wherein the thickness of the housing member varies across the predetermined field angle.

5 10. The invention of claim 2 further including a dedicated power source and means for providing a pulsed excitation of the light emitting diodes above a normal constant power level to conserve the power source and to increase illumination from the light emitting diodes.

11. A lightweight emergency lighting system adapted for use on helicopters and the like to identify an exit, comprising:

 an elongated flexible waterproof housing member capable of a directional transmission of light towards a predetermined field angle and of being bent to define an outline of an exit;

 a plurality of individual lighting elements positioned within the housing member and spaced along a substantial portion of its length;

 means for providing a pulsed excitation of the lighting elements to conserve power, and

 means for electrically interconnecting the lighting elements to the pulsing means whereby the lighting elements transmit light through the housing member towards the predetermined field angle.

12. The invention of claim 11 wherein the housing member includes a prismatic configuration for directing light towards the predetermined field angle.

13. The invention of claim 11 wherein the housing member includes a flat exterior surface and a non-planar interior surface for directing light.

14. The invention of claim 11 wherein the housing member has an interior surface that includes a pair of corner edges extending along the axial length of the housing member.

15. The invention of claim 11 further including an interior configuration of the housing member for frictionally holding the lighting elements in an operative position.

16. The invention of claim 11 wherein the means for providing a pulsed excitation of the lighting elements to conserve the power includes an autonomous dedicated power source.

17. The invention of claim 11 further including means for automatically activating the lighting system in an emergency.

18. The invention of claim 15 wherein the means for automatically activating includes a water sensor means for indicating contact with water.

19. A lighting system capable of arrangement into various subjective configurations to accomodate specific applications, comprising:

an elongated flexible housing member capable of transmitting light transverse to its length;

a plurality of individual lighting elements positioned within the housing member and spaced along its length, one portion of the interior surface of the housing member is configured to mount the lighting elements while another portion has a non-circular shape of a predetermined configuration for directing any light emitted towards a predetermined direction, and

means for electrically inter-connecting the lighting elements whereby connection to a source of electrical power can illuminate the lighting elements to transmit light through the housing member.

20. The invention of claim 24 wherein the interior surface has a prismatic configuration.

21. The invention of claim 25 further including a dedicated power source and means for providing a pulsed excitation of the lighting elements to conserve the power source, the lighting elements being light emitting diodes.

FIG. 1

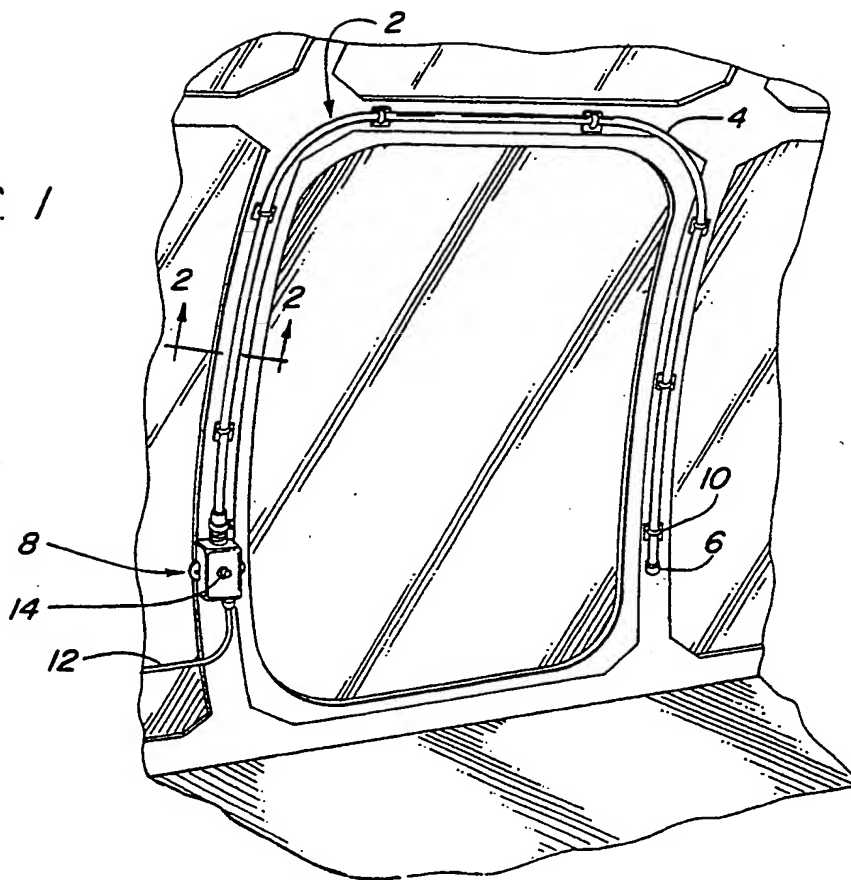


FIG. 2

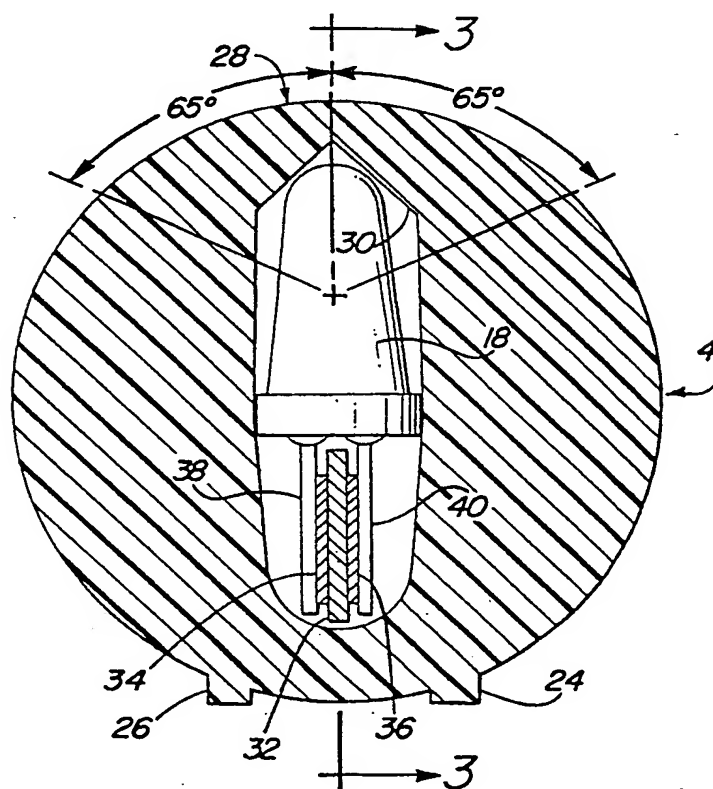


FIG. 3

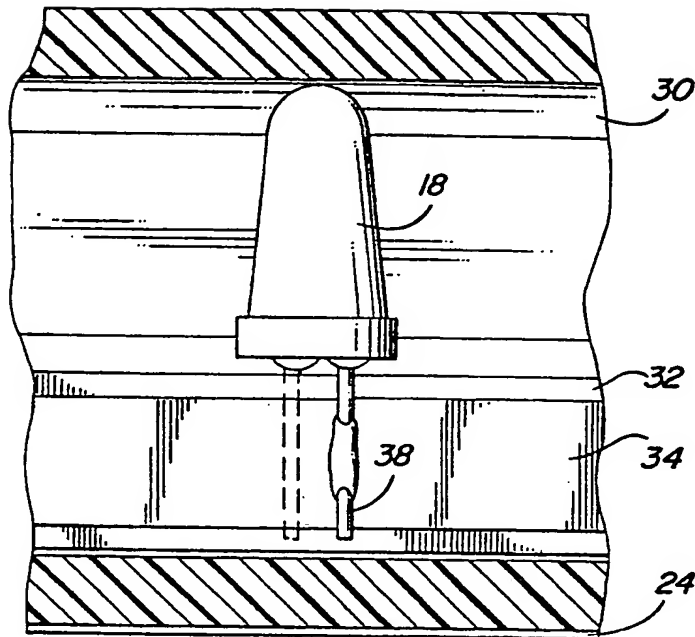


FIG. 4

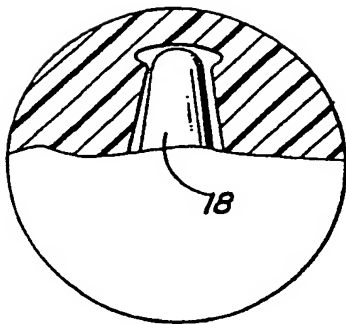


FIG. 5

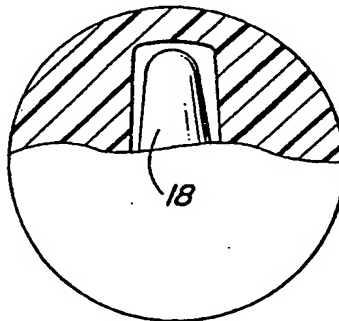


FIG. 6

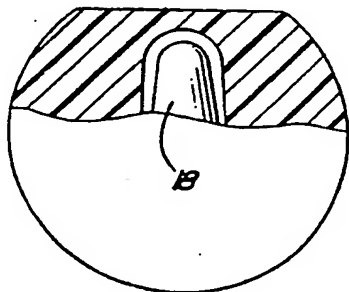
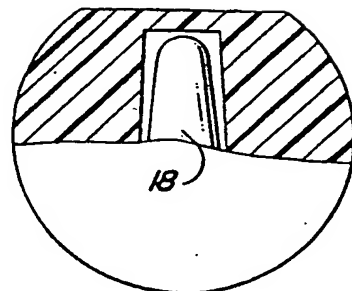


FIG. 7



The schematic diagram illustrates a battery charging system. A +28V power source is connected to a network of resistors (R1, R2, R3, R4), capacitors (C1, C2, C3, C4, C5), and diodes (D1, D2, D3, D4, D5, D6). A switch 42 is connected to ground. A lamp 44 is connected to the circuit. A relay assembly is shown, consisting of a Power Latch (containing a lamp 46 and a capacitor 56) and a Control Relay (containing a coil 48 and a diode 54). A trickle charging circuit 50 is also depicted, featuring a diode 51, a resistor 52, and a capacitor 53. A battery 58 is connected to the circuit. The diagram is labeled with various components and their interconnections.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y,D	US-A-4 376 966 (TIESZEN) * Figures 1,4,5 *	1-3	F 21 P 1/00 G 08 B 21/00
Y,D	US-A-4 107 767 (ANQUETIN) * Abstract *	1,2,4	
A,D	US-A-4 365 232 (MILLER) * Figure 6 *	5,11, 15-19	
A	US-A-3 551 723 (POPKO VAN GRONINGEN) * Figure 7 *	6	
A	FR-A-2 173 329 (GEBR. HAPPICH GmbH) * Figure *	7	TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
A	US-A-3 995 152 (CHAO) * Figures 1-9 *	1,8	F 21 P 1/00 F 21 P 1/02 G 08 B 5/38 G 08 B 5/36 G 08 B 21/00 G 09 F 13/28 G 09 F 13/22 B 60 Q 1/30 B 60 Q 1/32
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25-07-1984	Examiner ONILLON C.G.A.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			